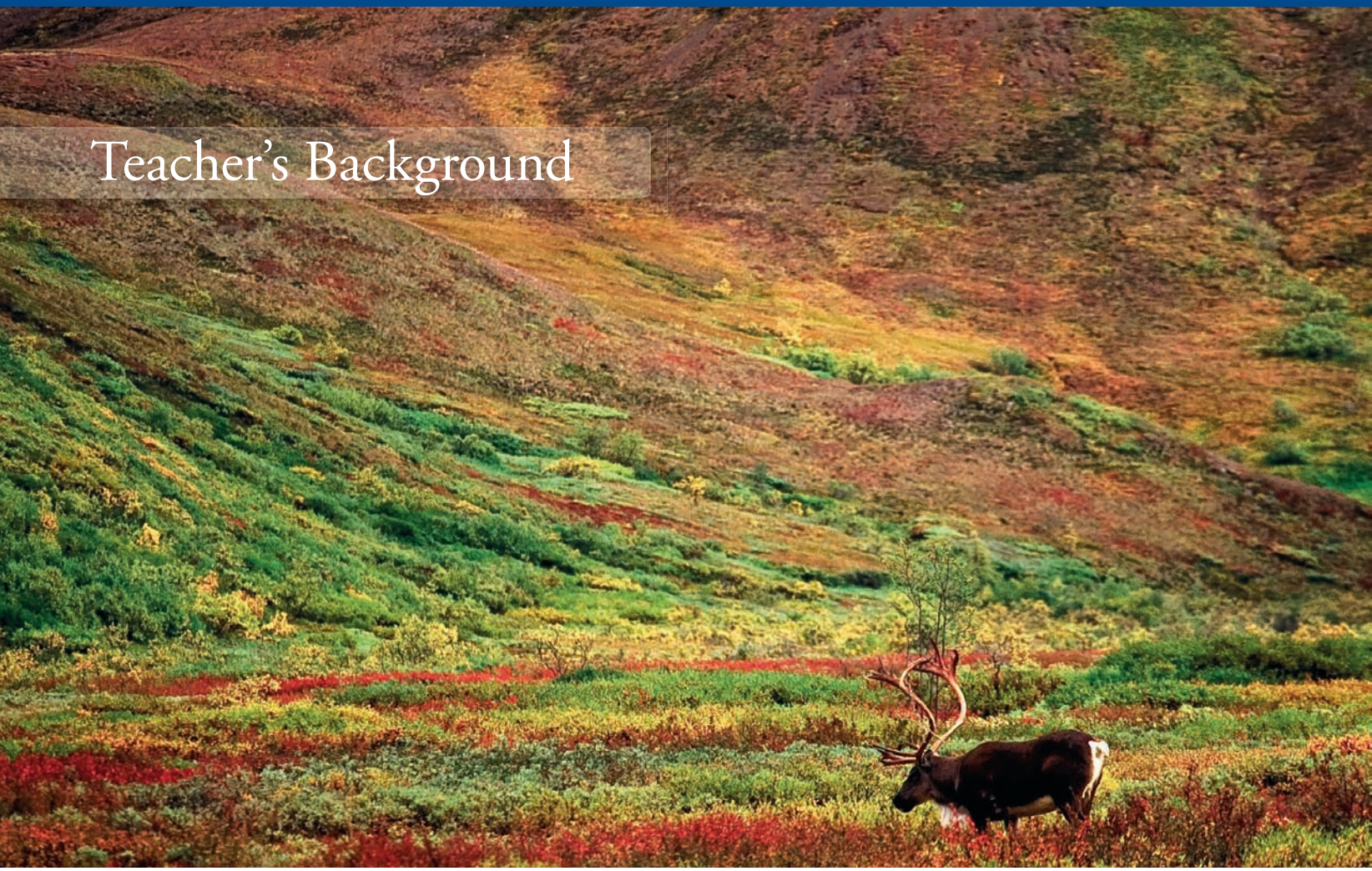
Teacher's Background



Reindeer in tundra

Biologists began using the abstract terms "biome" and "ecosystem" in the 1930s to describe and categorize our rich, diverse natural world. Scientists describe ecosystems as interacting systems of living and nonliving components, all connected to and dependent upon a wide variety of **natural processes**. Biomes describe similar ecosystems across the planet as a whole.

Biomes provide a way to categorize different kinds of natural communities, based on their climate and the characteristic plant and animal communities associated with that climate and geographic location. Biomes can be defined as the world's major natural communities associated with a particular climate and the characteristic organisms adapted to that climate.

Latitude, topography (particularly elevation), and proximity to warm or cold ocean currents shape a region's climate—the long-term patterns of temperature and precipitation in an area. A region's climate, in turn, influences the kinds of organisms that will be found there. The division of Earth's land area into major biomes reflects these broad-brush patterns of climate and plant and animal life.

Scientists classify regions by climate in a number of different ways. Wladimir Koeppen (1846-1940), a German climatologist, developed a system still widely used today. Koeppen's system uses temperature and precipitation data to classify Earth's continents into climatic zones. Temperature and precipitation are two of the easiest climate characteristics to measure, and probably the ones for which scientists can find the most data with the longest historical records. In this system, scientists group climates based on both annual averages and seasonal extremes of temperature and precipitation.

Climatograms are a simple way to show extremes and seasonal patterns for temperature and precipitation in a particular area. Climatograms for locations within the same biome will look similar, so they can be used as a way of identifying the characteristic climate and often the vegetation in a particular location.

Earth's terrestrial landscapes can be divided into nine biomes: alpine, chaparral, deciduous forest, desert, grassland, rainforest, savanna (also called woodland or veldt), taiga (coniferous forest), and tundra/polar. Some classifications divide rainforest into temperate and tropical. Other systems put alpine and tundra into the same category, and yet others name more or fewer biomes.

Regardless of exactly how the categories are defined, each biome has a distinct climate resulting from its distance from the equator (latitude), its elevation, and its proximity to ocean currents. For example, chaparral occurs only in "Mediterranean" climate zones—in western and southern coastal areas at latitudes of 30° to 50° N and 30° to 40° S. This occurs in places such as the west coasts of the United States, South America, and Australia, the south coast of South Africa, and the Mediterranean coastal areas. A quick look at a world map showing Earth's biomes reveals the influence of latitude, elevation, and oceans on the biome categories. Comparing a world biome map with a world climate map shows how closely the biome categories follow differences in climate.

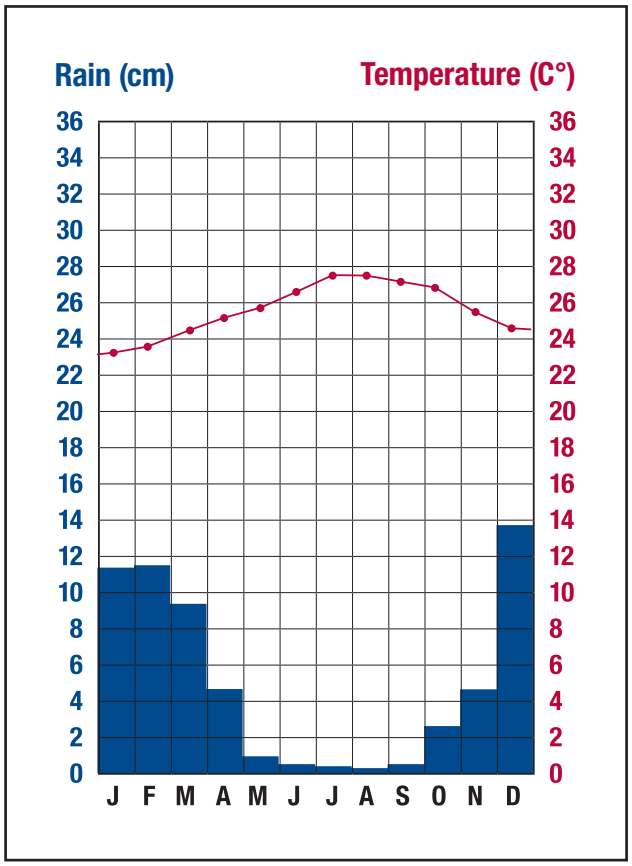
All ecosystems and all biomes have complex **food webs** with different organisms filling the ecological roles of producers, consumers (herbivores, carnivores, omnivores) and decomposers. This is the way in which matter and energy move through **natural systems**. All biomes contain these ecological roles, although the organisms filling them differ from biome to biome.

Without producers capturing the sun's energy and converting it into sugar, none of the other ecological roles would exist. Without decomposers helping "recycle" dead organic material within the system, dead material would accumulate, and plants would have difficulty getting the nutrients they need for growth and reproduction. The Arctic tundra looks like it has little in common with a Brazilian rainforest, but in each environment there are organisms filling these essential ecological roles, as matter and energy flow through complex food webs.

Because plants and animals are adapted to the specific environment in which they live, organisms in the same or similar biomes are likely to share some characteristics. For example, many mammals in forest biomes are adapted to life in trees, while many grassland mammals live in underground burrows to buffer the extreme changes in temperature in that environment. Because there is nowhere to hide, savannas usually support large herbivores that graze in herds as a defense against predation. On the other hand, many forest herbivores are smaller and solitary or live in pairs, as hiding is a more effective strategy for avoiding predation in that environment. No matter how similar or dissimilar the organisms, however, the same ecological roles are present, and matter and energy flow through food webs in similar ways.

Many human practices influence food webs and the ecological roles within them. Scientists consider habitat loss and fragmentation to be the factor that most influences the functioning of natural systems and populations of organisms; many scientists believe that climate change may have an even more significant influence in the future. The introduction of non-native species has also had considerable influence on populations of native organisms. Non-native species may disrupt food webs as new organisms compete with native organisms filling the same ecological role. Changes in these native populations then affect populations in other ecological roles, such as carnivores that rely on prey organisms. Domestic animals that have become wild, called **feral** animals, have become problems in California and elsewhere. Problem feral animals include pigs, cats, and even boa constrictors released into the wild after they became too large to keep as pets.

Feral cat



Climatogram for San Luis Obispo, California

Other human practices that influence the composition and functioning of ecosystems include overhunting or overharvesting, various types of pollution, and fire suppression. Overhunting and overharvesting have a direct influence on the "target" species and an indirect influence on associated species. For example, the loss of old growth redwood trees indirectly influences populations of the organisms that rely on them for nesting and roosting sites and for foods such as seeds, sap, insects, and other prey animals. The ways in which pollution influences wildlife populations are harder to measure, but studies have examined the effects of pesticides on eggshells, for example, and endocrine disruptors on reproduction, and found significant influences of specific compounds entering the environment as the result of human activities.

Changes in such ecological processes as natural fires can also influence the flow of matter and energy within ecosystems. Many plant species are adapted to regularly occurring fires and may not be able to reproduce without its effects. Before wildland managers realized the importance of fire to many ecosystems, fire suppression was common. These practices changed an area's plant composition. Changing the composition of plant populations resulted in changes to herbivore populations, which then influenced carnivore and omnivore populations.

Even in very different ecosystems and biomes, the effects of human practices on organisms filling the same ecological role are typically similar. For example, mercury pollution often has the greatest influence on top carnivores, whether in a freshwater ecosystem, deciduous forest, or taiga biome. Toxic methyl mercury accumulates in various organisms as it moves through the food web. Because of the food web relationships among producers, consumers, and predators, when a consumer ingests a pollutant like mercury, predators "up the food chain" begin to accumulate high doses of the toxic chemical.

Human practices that alter water systems directly influence those organisms living in the water and drinking the water. In addition, there are indirect influences on all the organisms dependent on those directly affected. This is true regardless of whether the water flows through savanna, grassland, chaparral, or desert.

When human activities cause a change in a population of organisms filling one ecological role within a food web, that change may have a "cascading effect." For example, forest fragmentation and the loss of large predators have led to overpopulation of white-tailed deer in many communities in the United States. Deer are herbivores, or primary consumers, in food webs. Growth in deer populations can cause a decline in populations of other herbivores relying on the same plants for food. In turn, this decrease in prey populations then influences the populations of carnivores that prey on these small herbivores. As deer populations expand, parasites, such as ticks, also thrive. Again, this change cascades to the organisms (including humans) on which the parasites feed and to which they can pass on diseases.

Agricultural production both relies on and influences ecological roles. Plants raised as crops rely on


Tick

natural processes including nitrogen and water cycling. Changes in these cycles affect plant productivity. Activities such as the diversion of surface water for irrigation influence food webs within and outside farms. Irrigation systems alter the natural flow of rivers and streams and lower lake levels, resulting in changes that influence populations of phytoplankton and algae. Changes in the populations of these producers influence other organisms tied to them through food webs.

While the organisms involved and the nature of these "cascading effects" are different in different ecosystems, the ways in which one disruption tends to lead to other disruptions are similar in every kind of environment. This is because the flow of matter and energy through ecosystems tightly binds organisms in food webs in every ecosystem and every biome. While we cannot expect that forestry practices in one woodland will have the same results as the same practice in a different kind of forest, the patterns of direct and indirect influences will show a great deal of similarity.

Ecological roles within food webs, or feeding relationships, are just one way in which different populations of organisms are interrelated. Organisms also often rely on others for shelter, and there are many complex symbiotic relationships, including parasitism, mutualism, and commensalism. In parasitism, one organism lives off and causes harm to another. In mutualistic relationships, both organisms benefit from the relationship, as in the case of a bird that eats insects off the body of a hoofed mammal. When one organism benefits while the other is unaffected, as in a small animal that hitches a ride with a larger one, it is a commensal relationship.

Ecological roles and their interrelationships are important to the healthy functioning of natural cycles, particularly the movement of matter and energy through the ecosystem. It is difficult to predict the specific effects of changes in one population within an ecosystem because the relationships are so complex. Some roles, if abandoned, are quickly taken over by other organisms, without significant changes in the flow of matter. In other cases, however, relationships and roles are less interchangeable, and the change in one population significantly influences the flow of matter and energy throughout the ecosystem.

Bird eating insects off an antelope deer

Glossary

Biome: A group of similar ecosystems defined by vegetation and climate, such as tundra, desert, and grassland.

Carnivore: An organism that obtains energy and matter primarily by eating animals.

Climatogram: A graph that displays both average monthly temperature and average monthly precipitation for a given area.

Decomposer: An organism, such as bacterium or fungus, that breaks down organic matter into its chemical and mineral components.

Feral: A term used to describe a domesticated animal that has returned to a wild state.

Food web: A complex pattern of several interacting food chains.

Herbivore: An organism that obtains energy and matter primarily by eating plants or plant products.

Natural process: A generally sequential and interconnected series of related events, activities, or phenomena (for example, photosynthesis).

Natural system: The interacting and/or interdependent components, processes, cycles, and interactions among organisms and their habitats.

Omnivore: An organism that obtains energy and matter by eating animals and plants or plant products.

Unit Planner

	Lesson	Learning Objective(s)	At a Glance
1	**A Tale of Feral Pigs** **Preparation Time:** 30 min. **Instructional Time:** 50 min.	■ Recognize different biomes. ■ Identify the characteristics of various biomes.	Students discover how non-native pigs were introduced into California and Australia and learn about similarities and differences in the two environments. They define the term "biome" and become familiar with the characteristics of biomes by comparing and contrasting savanna and chaparral.
2	**What Makes a Biome?** **Preparation Time:** 40 min. **Instructional Time:** 60 min.	■ Recognize different biomes. ■ Identify the characteristics of various biomes.	Students explore the nine terrestrial biomes by constructing climatograms (temperature and precipitation graphs) and matching them with the appropriate biome descriptions. They compare world climate and world biomes maps and discover their correlation. They learn that climate, latitude, and elevation distinguish biomes.
3	**Which Biome Do I Call Home?** **Preparation Time:** 15 min. **Instructional Time:** 45 min.	■ Identify the characteristics of various biomes.	Students study cards showing plant characteristics for each of the nine biomes, extending their knowledge to include typical vegetation and characteristics that enable plants to survive in each biome. Students take notes from short oral summaries to complete their biomes charts.
4	**Just Playing a Role** **Preparation Time:** 20 min. **Instructional Time:** 50 min.	■ Provide examples of different organisms playing similar ecological roles (herbivores, carnivores, omnivores, and decomposers) in similar biomes.	Students assemble food webs for each of the nine terrestrial biomes and identify ecological roles within them. Students then sort organisms according to their ecological roles to emphasize that while the organisms may differ, these same roles exist in every biome.

Prerequisite Knowledge

Students should be able to:
- use graphic organizers to take notes.
- define the term "omnivore" and describe the ecological role an omnivore fills in a food web.

Students should be able to:
- create and read bar graphs and line graphs.

Students should know that:
- organisms depend on abiotic components of the ecosystem, such as water.
- organisms compete with other organisms for resources.
- organisms must be able to survive within the constraints of the environment in which they live.
- plants lose water through evaporation from their leaves

Students should know about:
- food chains and energy transfer in food webs.

All Materials Needed

Lesson Toolboxes identify lesson-specific needs.

Activity supplies:
- String or yarn: 21 feet per class

A-V equipment:
Overhead or LCD projector, screen

Class supplies:
- Chart paper (eight sheets), markers, masking tape, scissors, transparency marker
- Colored pencils or markers (two pencils each of two colors per group), graph paper, pushpins, transparency markers (two colors)
- Glue sticks or tape, pencils, scissors
- Pencils
- Pushpins

Textbook Alignment

Houghton Mifflin: Unit D Ch. 8: 294-297, 301, 308-315, 318-323, 326

Macmillan/ McGraw-Hill: Pages 98-125, 127, 147, 150-155

Harcourt: Unit 5 Lesson 4

Holt: SE Pages 582-591, 608-611

Glencoe: Primary Pages 536, 564

Prentice Hall: Chapters 10, 11

CPO: TE Pages 301, 317, 328

Unit Planner

	Lesson	Learning Objectives	At a Glance
5	**Here a Pig, There a Pig…** **Preparation Time:** 20 min. **Instructional Time:** 45 min.	■ Explain how human practices make use of and/or have similar effects on organisms that play similar roles in different biomes.	Students revisit ***California Connections: A Tale of Feral Pigs***. They predict and verify the ecological role of the feral pigs in both California and Australia and explore the effects of feral pigs on ecological roles in two similar biomes.
6	**Human Practices and the Transfer of Matter** **Preparation Time:** 15 min. **Instructional Time:** 45 min.	■ Describe the effects of human practices on the transfer of matter through natural systems (for example, the effects of agriculture and forestry on organisms with similar ecological roles are comparable in similar biomes).	Students read case studies about logging and agriculture in two California ecosystems They identify ways that changes to these ecosystems affect the transfer of matter through foods webs. Students then compare these two situations to the story of feral pigs.

Prerequisite Knowledge	All Materials Needed	Textbook Alignment
Students should be able to: ■ identify ecological roles in a food web. **Students should have:** ■ completed Lesson 1.		
Students should have: ■ completed previous lessons.		

English Language Development

Lessons in the EEI Curriculum are designed to support students' English language development. The strategies in these lessons are based on some of the practices identified in the Reading/Language Arts Framework for California Public Schools (California Department of Education 2007) and ideas adapted from the San Joaquin County Office of Education's Regional Technical Assistance Center.

To establish successful instructional strategies for all students, the teacher should:

- **Use a wide variety of ways to explain a concept or assignment.** When appropriate, the concept or assignment may be depicted in graphic or pictorial form, with manipulatives, or with real objects to accompany oral and written instructions.

- **Provide assistance in the specific and general vocabulary** prior to the each lesson, using reinforcement and additional practice afterward. Instructional resources and instruction should be monitored for ambiguities and language that could be confusing to students, such as idioms.

- **Ask each student frequently to communicate** his or her understanding of the concept or assignment. Students should be asked to verbalize or write down what they know, thereby providing immediate insight into their thinking and level of understanding. In addition, students should be encouraged to confer about each other's understanding of the concept being taught and the classwork or homework assignments, particularly if the students are not fully proficient in English.

- **Check frequently for understanding in a variety of ways.** When a student does not understand, analyze why.

- **Allow students to demonstrate their understanding and abilities** in a variety of ways while reinforcing modes of communication that are used on standardized tests.

- **Use pacing to differentiate instruction according to students' needs.** Reinforce the more difficult concepts for students experiencing difficulty in the language arts by providing additional time and using the visual aids provided. Accelerate the instructional pace for advanced learners if the assessments indicate mastery of the standard.

The California EEI Curriculum includes a variety of research-based English language development practices, such as:

Vocabulary Development

- Teach difficult vocabulary prior to and during the lesson
- Provide reading, speaking, and assessment tasks that reinforce new vocabulary

Reading Comprehension

- Use grade-level readers, articles, and reading assignments to build comprehension in the content area
- Engage students in meaningful interactions about text
- Provide activities that assess student comprehension and build decoding skills

Writing Strategies and Applications

- Provide opportunities for students to organize ideas and information in a written form including concept maps
- Use stories, articles and other written materials to model good writing
- Provide assessment tasks that allow students to apply their grade-level writing skills

Listening and Speaking Strategies and Applications

- Ask questions to ensure comprehension
- Elicit responses from all students, encourage students to give elaborate responses, and give students time to respond to questions
- Incorporate students' responses, ideas, examples, and experiences into the lesson
- Model and teach language patterns needed to understand and participate in the study of the content areas
- Encourage a high level of response accuracy
- Use visual aids, manipulatives, and real objects to support content delivery

The lessons in this unit can be used to support a variety of English language arts skills. This matrix summarizes how each of the lessons can be used to support English language development.

	V Vocabulary	R Reading	W Writing	L Listening	S Speaking
Lesson 1	✓	✓			
Lesson 2	✓	✓		✓	✓
Lesson 3	✓	✓		✓	✓
Lesson 4	✓	✓	✓	✓	✓
Lesson 5	✓	✓	✓	✓	✓
Lesson 6	✓	✓		✓	✓

Differentiated Instruction

The 2007 Reading/Language Arts Framework for California Public Schools (California Department of Education 2007) provides guidance for helping students with diverse abilities succeed with California's English–Language Arts Content Standards. The instructional units developed for California's Education and the Environment Initiative provide ample opportunities for teachers to differentiate instruction to meet these needs.

It is important to take into account the State Board of Education's and Department of Education's guidance on differentiated instruction while implementing this instructional unit. Page 263 of the 2007 Framework summarizes this guidance as follows:

The diversity of California's students presents unique opportunities and significant challenges for instruction. Students come to school with a wide variety of skills, abilities, and interests as well as varying proficiency in English and other languages. The wider the variation of the student population in each classroom, the more complex becomes the teacher's role in organizing high-quality curriculum and instruction in the language arts and ensuring that each student has access according to the student's current level of achievement. The ultimate goal of language arts programs in California is to ensure access to high-quality curriculum and instruction for all students in order to meet or exceed the state's English–language arts content standards. To reach that goal, teachers need assistance in assessing and using the results of that assessment for planning programs, differentiating curriculum and instruction, using grouping strategies effectively, and implementing other strategies for meeting the needs of students with reading difficulties, students with disabilities, advanced learners, English learners, and students with combinations of special instructional needs.

Procedures that may be useful in planning for universal access are to:

- *Assess each student's understanding at the start of instruction and continue to do so frequently as instruction advances, using the results of assessment for program placement and planning.*
- *Diagnose the nature and severity of the student's difficulty and modify curriculum and instruction accordingly when students have trouble with the language arts.*
- *Engage in careful organization of resources and instruction and planning to adapt to individual needs. A variety of good teaching strategies that can be used according to the situation should be prepared.*
- *Differentiate when necessary as to depth, complexity, novelty, or pacing and focus on the language arts standards and the key concepts within the standards that students must master to move on to the next grade level.*
- *Employ flexible grouping strategies according to the students' needs and achievement and the instructional tasks presented.*
- *Enlist help from others, such as reading specialists, special education specialists, parents, aides, other teachers, community members, administrators, counselors, and diagnosticians when necessary and explore technology or other instructional devices or instructional materials, such as braille text, as a way to respond to students' individual needs.*

Additional information about best practices in differentiated instruction are detailed in Chapter 7 of the Framework.

Traditional Unit Assessment

Description

Biomes and Ecological Roles (Traditional Unit Assessment Master) assesses student understanding of world biomes, the similarities in their ecology, and human influences on their functioning. The multiple-choice, matching, and short-answer sections assess knowledge of the characteristics of each biome and students' depth of understanding of the similarities and differences of ecosystems in all biomes. The short-answer section requires that students apply their understanding of how human practices affect organisms. These affected organisms have the same ecological roles in the context of two unfamiliar food webs.

Suggested Scoring

Use the Answer Key provided on pages 22–27.

Advanced Preparation

Gather and prepare Assessment Masters.

Preparation Time

10 min.

Assessment Time

45 min.

Answer Key and Sample Answers

Biomes and Ecological Roles

Traditional Unit Assessment Master | *page 1 of 6*

Name: _____

Multiple Choice: Select the best answer and circle the correct letter. (One point each)

1. The network of feeding relationships in an ecosystem is called a:
   a. flow chart
   (b.) food web
   c. biome
   d. energy pyramid

2. The type of biome found in an area is determined by its:
   (a.) climate
   b. animals
   c. plants
   d. all of the above

3. A climatogram shows a biome's:
   a. precipitation
   b. latitude
   c. temperature
   (d.) temperature and precipitation

4. Biomes that are very cold and dry are:
   a. tundra/polar and chaparral
   b. deciduous forest and desert
   c. taiga and savanna
   (d.) tundra/polar, taiga, and alpine

5. A middle latitude biome dominated by broad-leafed trees that has four seasons is:
   a. rainforest
   b. taiga
   (c.) deciduous forest
   d. tundra/polar

6. The biome dominated by coniferous trees is:
   (a.) taiga
   b. tundra/polar
   c. deciduous forest
   d. rainforest

7. Feral pigs fill the ecological role of:
   a. carnivore
   (b.) omnivore
   c. decomposer
   d. producer

Answer Key and Sample Answers

Biomes and Ecological Roles

Traditional Unit Assessment Master | *page 2 of 6*

Name: _____

Matching Draw a line between the name of biome and the correct photograph. (One point each)

1. Rainforest
2. Taiga
3. Tundra/polar
4. Grassland
5. Desert
6. Deciduous forest
7. Chaparral







Biomes and Ecological Roles

Traditional Unit Assessment Master | *page 3 of 6*

Name: _____

Short Answer

1. Name the three biomes found in California. Describe the climate, common vegetation, and plant characteristics of each one. (One point for naming the biome and one point for each characteristic listed up to three.)

   a. Biome: *Rainforest*

   Description: *Warm or hot year-round; very wet; many species; tall straight trees that form a canopy; plants can tolerate wet conditions; understory shrubs can tolerate very low light*

   b. Biome: *Chaparral*

   Description: *Warm in winter, hot in summer; wetter in winter, very dry in summer; found on slopes near California's coast; scrub plants most common; plants can tolerate dry conditions*

   c. Biome: *Desert*

   Description: *Very dry, and all hot in California but can be cold in other parts of the world; big temperature difference between night and day; few plant species and all can tolerate dry conditions; tough leathery covering, tubers below ground and other strategies for retaining water.*

2. Do prairie dogs and coyotes play the same ecological role in the American grassland biome? Explain your answer. (5 points)

   No. Prairie dogs are herbivores; they eat plants. Coyotes are omnivores; they eat both plants and animals. (Extra credit: Their roles may overlap, because they may eat some of the same plants.)

Answer Key and Sample Answers

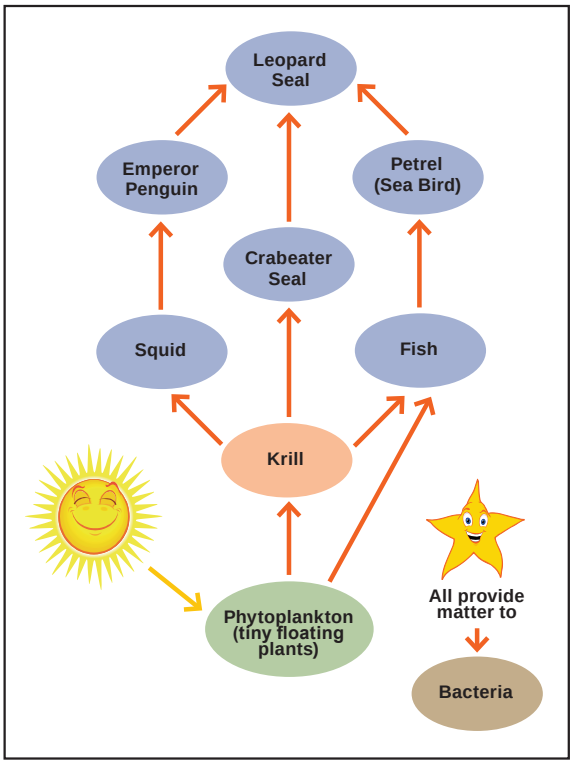
Biomes and Ecological Roles

Traditional Unit Assessment Master | *page 4 of 6*

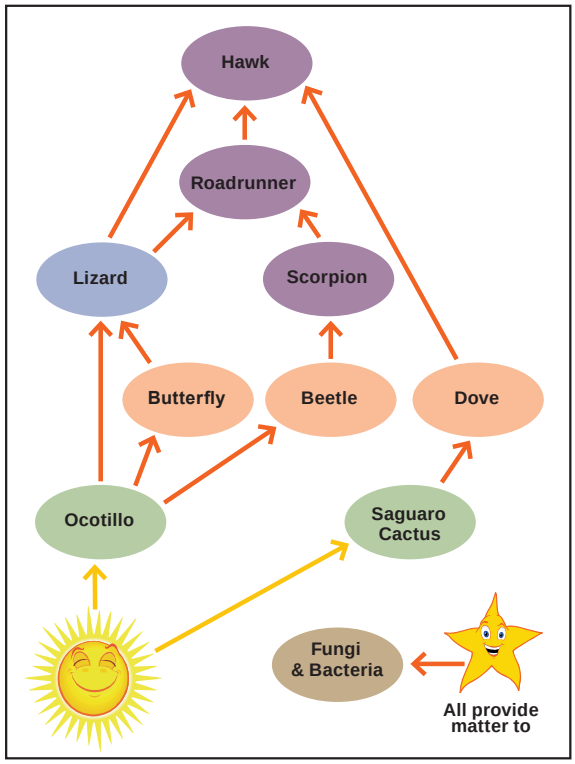
Name: _____

Use the two food webs below to answer Questions 3 and 4.

Antarctic Food Web



Sonoran Desert Food Web



3. Find an organism in the first web and one in the second web that are playing the same ecological role. *(see additional answers at bottom of page)*

Organism in the Antarctic food web (One point): *krill*

Organism in the desert food web (One point): *butterfly, dove, or beetle*

Ecological role that they share (One point): *herbivores*

Additional answers for question 3:

Antarctic: phytoplankton
Desert: ocotillo or cactus
Role: producer

Antarctic: seals, penguins,
Desert: hawk, roadrunner, or scorpion
Role: carnivores

Name: _____

4. "Overharvesting" is a human practice of taking more organisms from a population than what the population can replace. (Six points total)

   a. Explain how overharvesting the fish might directly and indirectly affect the Antarctic food web.

   Direct effect on petrel: *less matter is transferred to them; populations may decrease.*

   Direct effect on krill, their prey; populations may increase.

   Indirect effects: *smaller petrel populations mean less prey for leopard seals; less matter transferred to top predators in the web. Populations of other krill predators may grow, influencing more matter transferring through those feeding relationships. If other predators do not take in more krill, the phytoplankton population may decrease.*

   b. Explain how overharvesting the lizards might directly and indirectly affect the desert food web.

   Direct effect on roadrunners (their predator): *less matter transferred to them; population may decrease. Direct effect on butterflies, their prey; populations may increase. Also, on hawk and ocotillo.*

   Indirect effects: *smaller roadrunner population means less prey for hawks; less matter transferred to top predator in the web. Populations of other butterfly predators may grow, influencing more matter transferring through those feeding relationships. If other predators do not take in more butterflies, less matter from ocotillo will be available to the butterfly.*

Answer Key and Sample Answers

Biomes and Ecological Roles

Traditional Unit Assessment Master | *page 6 of 6*

c. Compare and contrast the two situations:
- In what ways might the outcomes of overharvesting be similar?
- In what ways might they be different?

Similar: *In both cases, there are direct and indirect effects on populations. In both, there are changes in the transfer of matter; it increases in some places and decreases in others. (Advanced answer: In both cases, the effects are difficult to predict because it is difficult to know all the relationships and how each population will respond.)*

Different: *The organisms involved are different. The outcomes may be different because the populations of different organisms will likely respond in different ways; for instance, some may adapt to the change more easily than others may.*

Alternative Unit Assessment

Description

Students compare two biomes of their own selection and describe their common and unique features. Each student completes a chart describing the climate; identifying typical characteristics; providing examples of herbivores, carnivores, omnivores, and decomposers; and explaining how human practices affect organisms and the transfer of matter through ecosystems in those biomes. This assessment offers an alternative method to evaluate whether students have learned that different kinds of organisms play similar ecological roles in similar biomes.

Advanced Preparation

Gather and prepare Materials Needed.

Gather and prepare Assessment Masters:

- Copy **Comparing Biomes** two-sided.
- Copy **Biome Photos**

Materials Needed

Class Supplies:

- Glue sticks or tape, pencils, scissors

Alternative Unit Assessment Masters

- **Comparing Biomes**
  SM, Pages 10–12
  One per student
- **Biome Photos**
  SM, Page 13
  One per student

Suggested Scoring

Use the rubrics on pages 29–30 to score the alternative unit assessment. The rubrics describe elements that should be included on the students' charts. The rubrics provide point values; the entire assessment is worth 30 points. A full-score sample student answer is provided; answers specific to other biomes can be found on the Answer Keys to the **World Biomes Task Sheet** (Lesson 2 Activity Master), completed in Lesson 3 and found on pages 84-87, and on the **Same Roles Homework** (Lesson 4 Activity Master) on pages 100-102.

Preparation Time

10 min.

Assessment Time

60 min.

Safety Notes

None

Procedures

Step 1

Distribute copies of **Comparing Biomes** (Alternative Unit Assessment Master) and **Biome Photos** (Alternative Unit Assessment Master). Ask students to choose any two of the nine biomes studied in the unit and use their choices to complete the chart and the writing/drawing assignment on this assessment. For the first question, students are to cut the appropriate biome photo from the master sheet and glue it into place on the chart.

Scoring Tool for Alternative Unit Assessment

Comparing Biomes Rubric

Element	1 point	2 points	3 points
Choose the correct photo from the photo page and paste it in place here.	Correctly identifies one biome by placing one correct photo.	Correctly identifies both biomes by placing two correct photos.	—
Describe the location and climate of the biome.	Correctly describes the location, typical temperature, and precipitation of one biome.	Correctly describes the location, typical temperature, and precipitation of both biomes.	Correctly describes the location, typical temperature, and precipitation of both biomes and describes seasonal differences.
Describe the typical vegetation.	Correctly describes the prominent type of vegetation found in one biome.	Correctly describes the prominent type of vegetation found in both biomes.	Correctly describes the prominent vegetation in both biomes and some of the characteristic features (shrubs close together, tall trees).
Describe at least two characteristics that plants living in the biome might have.	Correctly describes two characteristics typically found in plants from only one of their biomes, or describes only one characteristic.	Correctly describes two characteristics typically found in plants from each biome.	Correctly describes three or more characteristics typically found in plants from each biome.
Name one producer, one herbivore, one carnivore, one omnivore, and one decomposer that might live in the biome.	Correctly identifies appropriate species for one or two of the ecological roles in both biomes, or correctly identifies appropriate species for all three or four ecological roles in one biome.	Correctly identifies appropriate species for three or four of the ecological roles in both biomes, or correctly identifies appropriate species for all five ecological roles in only one biome.	Correctly identifies appropriate species for all five ecological roles in both biomes.

Scoring Tool for Alternative Assessment

Comparing Biomes Rubric

Element	1-2 points	3-4 points
Effects of human practice on the number of producers	Student generally identifies that the decline of producers will affect the rest of the food web.	Student identifies that the decline of producers will affect the rest of the food web and result in herbivores having less food available.
Effects of declining producers on transfer of matter through food webs	Student generally identifies that the decline of producers will result in changes throughout the food web and gives only one (or no) examples of specific changes.	Student identifies that the decline of producers will result in changes throughout the food web and gives two clear examples of such changes (such as herbivores may not be able to find enough food, carnivores will face more competition) that are relevant to the chosen biome.
Similarity in changes between biomes	Student explains that changes will affect species in similar ecological roles in the same way.	Student gives a detailed explanation concluding that organisms that play similar roles in both biomes will be similarly affected by a change in the transfer of matter in the ecosystem.
Differences in changes between biomes	Student explains that the species will differ between biomes because different species live in different biomes.	Student gives a detailed explanation concluding that the specific conditions in a biome mean that different species live in different biomes. A change in the transfer of matter within ecosystems in any biome will have similar effects on organisms that fill similar ecological roles.

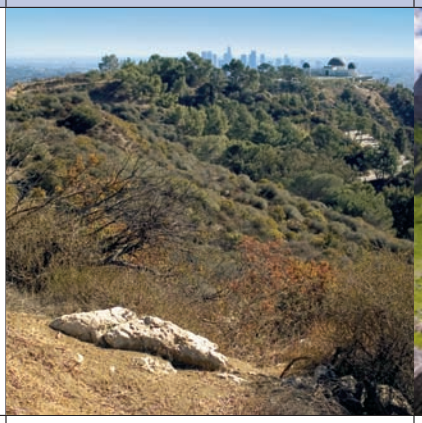
Answer Key and Sample Answers

Comparing Biomes

Alternative Unit Assessment Master | *page 1 of 3*

Name: _____

Choose any two biomes. Use them to complete the following chart and writing/drawing assignment. Fill in the names of the biomes at the top of the chart.

	Biome: *Chaparral*	**Biome:** *Alpine*
Choose the correct photo from the photo page and paste it in place here.		
Describe the location and climate of the biome.	*Chaparral is found in middle latitudes. There is a lot of chaparral in California, along the coast and in the foothills. There are mild, wet winters and hot, dry summers.*	*Alpine is found high in the mountains at all latitudes. It is very cold in the winter, and there is a lot of snow. Summers are short and mild.*
Describe the typical vegetation.	*Shrubs grow close together.*	*There are small, low-growing plants and few or no trees.*

Comparing Biomes

Alternative Unit Assessment Master | *page 2 of 3*

Name: _____

	Biome: *Chaparral*	**Biome:** *Alpine*
Describe at least two characteristics that plants living in the biome might have.	*Chaparral plants have small, thick leaves to conserve water in summer. Smaller surface areas lose less water. The waxy coating on the leaves also reduces evaporation. Chaparral plants have shallow roots to collect rainwater soon after it falls.*	*Alpine plants grow close to the ground so they are not blown over by the wind. Their leaves are small to conserve water and shiny to reflect sunlight. The parts that grow above ground die in winter, and the plants become dormant.*
Name one producer, one herbivore, one carnivore, one omnivore, and one decomposer that might live in the biome.	Producer: *manzanita* Herbivore: *butterfly* Omnivore: *coyote* Carnivore: *lizards* Decomposer: *bacteria*	Producer: *lichen* Herbivore: *pika* Omnivore: *brown bear* Carnivore: *snow leopard* Decomposer: *bacteria*

Imagine that human practices cause the number of one of the main producers in each of your biomes to decline. Choose one of your biomes. Describe or draw what might happen. How would this affect the transfer of matter through the foods webs? Include at least two changes that might occur. The changes can be direct or indirect changes.

Biome: Chaparral

If human practices cause the number of producers in the chaparral to decline, it will affect the entire food web. The herbivores, like butterflies and mice, that eat producers, may not be able to find enough to eat. If some of the herbivores do not survive, less food will be available to omnivores and carnivores. Less matter will be transferred to higher-level animals. Competition for food resources could increase, and animals like coyotes and lizards might die of starvation.

Answer Key and Sample Answers

Comparing Biomes

Alternative Unit Assessment Master | *page 3 of 3*

Name: _____

How would the responses in each of your biomes be similar?

If the number of producers goes down, plants and animals in similar roles in both biomes will be affected in similar ways. Less matter is transferred throughout the food web. The herbivores will be affected by the lower number of producers; they will have less to eat. The carnivores and omnivores will be affected by the change in herbivores; they will also have less to eat. The decomposers will be affected by the changes in other organisms. The two biomes are also similar in that there will be both direct and indirect effects from the change.

How would the responses in each of your biomes differ?

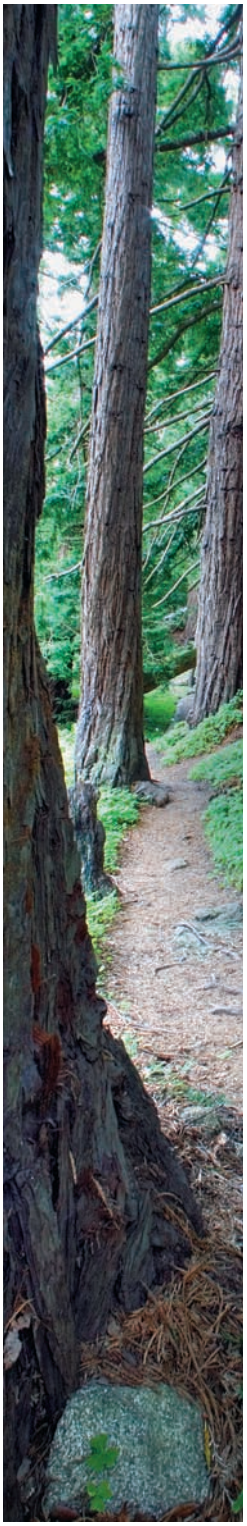
Human practices affect plants and animals filling the same ecological roles, but the specific kinds of plants and animals will be different. Different biomes have different climates, so they have different plants and animals living there.

Biome Photos

Alternative Unit Assessment Master

Name: _____

Extensions & Unit Resources



Extension Ideas

Plan a field trip to one or more of the California biomes described in this unit: the redwood forest, the desert, or the chaparral. Arrange a visit to a park with docents who can provide a guided tour that describes the biome's climate, characteristic plant communities, plant and animal adaptations, and historical changes to the ecosystem as a result of human practices. If an actual visit is not possible, lead students on a "virtual" field trip using videos, software, or library materials. Have advanced students prepare a brochure or visitor guide that describes the biome, its typical plant and animal species, special characteristics of organisms there, and ways in which human practices have influenced the transfer of matter through the natural systems.

Find a local nursery that specializes in native plants and assemble several examples of desert, chaparral, and redwood forest plants in the classroom. Assign different plants to groups of students and have them research their care requirements and maintenance.

Resources for Students

The GLOBE Program. Match the Biomes!
http://www.globe.gov/fsl/events/helsinki2/helsinki/biome/game.pl?lang=en&nav=1

Missouri Botanical Gardens. What's It Like Where You Live? **http://www.mbgnet.net/**

NASA Earth Observatory. Mission: Biomes. **http://earthobservatory.nasa.gov/Laboratory/Biome/**

National Park Service North Cascades. Salmon of the Skagit River Watershed.
http://www.nps.gov/archive/noca/salmn6-2.htm

References for Teachers

California Department of Fish and Game. Colorado Desert—An Overview.
http://www.dfg.ca.gov/wildlife/WAP/region-colorado.html

California Forest Stewardship Program. Landowners Can Aid in Coho Recovery.
http://www.ceres.ca.gov/foreststeward/html/coho.html

Center for Biological Diversity. Quino Checkerspot Butterfly.
http://www.biologicaldiversity.org/swcbd/species/QuinoCheckerspot/index.html

Center for Biological Diversity. Salton Sea Restoration Proposals Don't Make the Grade.
http://actionnetwork.org/BIODIVERSITY/alert-description.html?alert_id=6389715

CERES. The Colorado Desert—An Overview.
http://www.ceres.ca.gov/geo_area/bioregions/Colorado_Desert/about.html

Picadome. Biomes.
http://www.picadome.fcps.net/lab/currl/biomes/default.htm

Salmon and Steelhead Recovery Coalition. 2000. Endangered Species Petition: Coho Salmon (*oncorhyncus kisutch*). Sacramento, CA. Submitted to the California Fish and Game Commission. **http://www.pcffa.org/cesacoho.htm**

State of California. Coho Salmon Recovery. **http://www.dfg.ca.gov/nafwb/CohoRecovery/**

Instructional Support

Agencies, institutions, and organizations throughout California have identified themselves as providing programs and materials that support this unit. Links to these resources are available at **http://www.calepa.ca.gov/Education/EEI/instructional_support.html**